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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/604,060	06/24/2003	Richard A. Conti	FIS920030135US1	1059

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EXAMINER	
YEVSIKOV, VICTOR V	

ART UNIT	PAPER NUMBER
2825	

DATE MAILED: 11/12/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/604,060	CONTI ET AL.	
	Examiner	Art Unit	
	Victor V Yevsikov	2825	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *25 August 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-23* is/are pending in the application.

4a) Of the above claim(s) *16* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-15 and 17-23* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *25 August 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1 and 8-14 are rejected under 35 U.S.C. 102(b) as being anticipated by U.S. Patent No. 5,930,655 (Cooney, 111 et al.) ("Cooney").

Cooney discloses a process to denude fluorine form a dielectric layer the process comprising after the CMP step of a metal and fluorine-containing dielectric wire structure (Fig. 3), generating atomic hydrogen species and exposing the fluorine-containing dielectric to the atomic hydrogen species so as to lower the amount of fluorine from the dielectric material. (col. 6, lines 35-45) The atomic hydrogen species are generated via a plasma or heating process in a furnace wherein a hydrogen-bearing compound such as hydrogen or hydrogen and an inert gas is used. (col. 6, lines 35-44). The metal layer may comprise copper. (col. 3, lines 35-45). The fluorine-containing dielectric, such as SiOF, is completely denuded of fluorine. (col. 5, lines 22-28 and col. 6, lines 59-62).

Claim 23 is rejected under 35 U.S.C. 102(e) as being anticipated by U.S. Patent No. 6,433,432 B2 (Shimizu).

Shimizu discloses a process to form a wiring structure comprising a copper conductor and a fluorine-containing dielectric wherein the fluorine-containing layer (item 5) is deposited and patterned to form vias that are to be filled with copper material (item 9) and planarized to form damascene structures (Fig. 3C-F), forming a plasma from a hydrogen bearing gas such as ammonia to generate atomic hydrogen species together with nitrogen gas (col. 5, lines 10-15) and exposing the fluorine-containing dielectric to the hydrogen species thereby removing the fluorine from the surface of the fluorine-containing material. (Fig. 3F and col. 5, lines 1-10).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 2-7 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 5,930,655 (Cooney, III et al.) ("Cooney").

As stated in paragraph 3, all the limitations of these claims have been met except for specifying that the fluorine is removed in at least about 700 angstroms or less or equal to 20 percent of the dielectric layer thickness.

While Cooney does not specify the thickness of the dielectric from which the fluorine is removed such a limitation would be obvious to one with ordinary skill in the

specific art since such a variation would only require a mere change in size and a change in size is generally recognized as being within the level of ordinary skill in the art. *In re Rose*, 105 SUPQ 237 (CCPA 1955).

Claims 15,22 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 6,433,432 B2 (Shimizu) in view of U.S. Patent Application Publication No. 2002/0063312 A1 (Towle et al.).

Shimizu discloses a process to form a wiring structure comprising a copper conductor and a fluorine-containing dielectric wherein the fluorine-containing layer (item 5) is deposited and patterned to form vias that are to be filled with copper material (item 9) and planarized to form damascene structures (Fig. 3C-F), forming a plasma from a hydrogen bearing gas such as ammonia to generate atomic hydrogen species and exposing the fluorine-containing dielectric to the hydrogen species thereby removing the fluorine from the surface of the fluorine-containing material. (Fig. 3F and col. 5, lines 1-10).

Shimizu does not disclose the use of hydrogen gas to generate atomic hydrogen species. Shimizu also does not specify that the fluorine is removed in at least about 700 angstroms or less or equal to 20 percent of the dielectric layer thickness.

Towle et al. teach the removal of fluorine from a dielectric by exposing it to atomic hydrogen species created in a plasma where the atomic hydrogen species may be obtain from either ammonia or hydrogen gas. (§0019)

It would have been obvious to one with ordinary skill in the specific ad to use hydrogen as opposed to ammonia, since Towle et al. explicitly teach that these two

precursor gasses are interchangeable in this process.

Furthermore, while Shimizu does not specify the thickness of the dielectric from which the fluorine is removed such a limitation would be obvious to one with ordinary skill in the specific ad since such a variation would only require a mere change in size and a change in size is generally recognized as being within the level of ordinary skill in the art. In re Ro4e, 105 SUPQ 237 (CCPA 1955).

Response to Arguments

Applicant's arguments filed on July 27, 2004 have been fully considered but they are not persuasive.

With respect to claim 1, and the claims dependent thereon, applicant argues the prior ad does not anticipate the limitation of claim 1 because the Cooney fails to disclose a process that *consists essentially of* generating atomic hydrogen species; and exposing the fluorine-containing dielectric to the atomic hydrogen species in an amount effective to lower the fluorine content in the fluorine-containing dielectric.

The examiner directs applicant's attention to columns 2 and 3, lines 58-1 of the Cooney reference where it is disclose that a plasma may be induced during the heat treatment -"To form the fluorine-free barrier layer in this manner, the fluorine-containing insulator material can be annealed in hydrogen gas with or without plasma, or alternatively, can be exposed to a plasma of oxygen or ozone, to deplete and cause elimination of fluorine from the surface regions of a fluorine-containing insulator material to create a fluorine-free layer in the surface regions of the insulator material. With such

hydrogen annealing, it is thought that HF gas is formed which evolves from the surface of the insulator material to provide the fluorine-free region".

Furthermore, the examiner directs applicant's attention to Detailed Action, dated 06/25/04, pages 5 and 6.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Victor Yevsikov whose telephone number is (571) 272-1910. The examiner can normally be reached on Monday –Thursdays 8:00-5:30.

If attempts to reach the examiner by telephone are unsuccessful, examiner's supervisor, Matthew S. Smith, can be reached on (571) 272-1907. The fax phone numbers for the organization where this application or processing is assigned is (703) 873-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published application may be obtained from either Private PAIR or Public PAIR. Status information for unpublished application is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

V. Yevsikov

Victor Yevsikov
Examiner
Art Unit 2825

October 26, 2004

MATTHEW SMITH
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2800